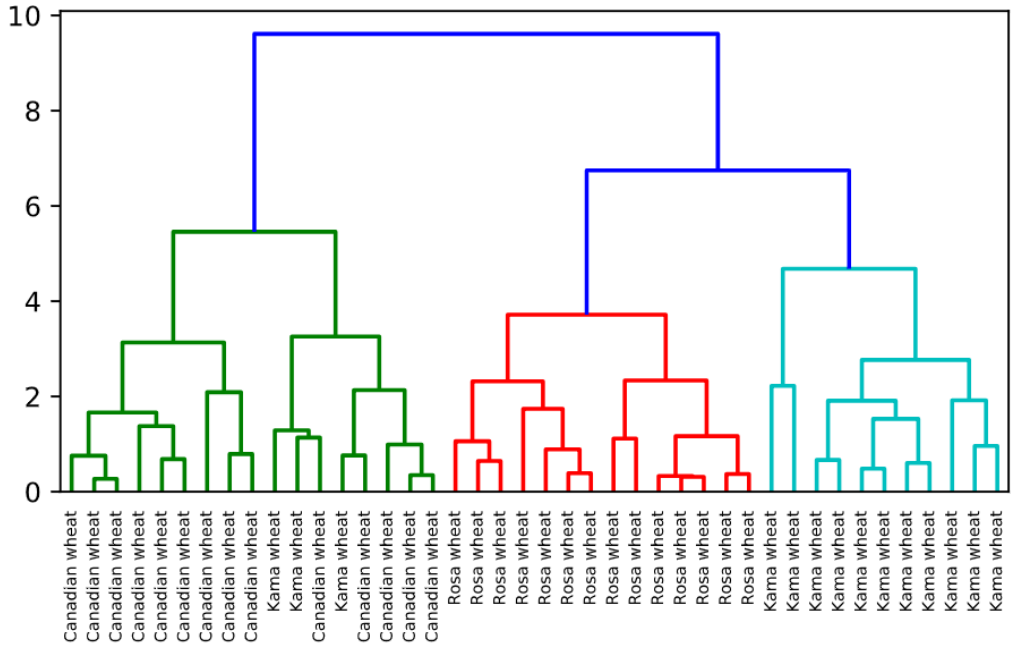
# Unsupervised Learning in Python

## 2). Visualization with hierarchical clustering and t-SNE:

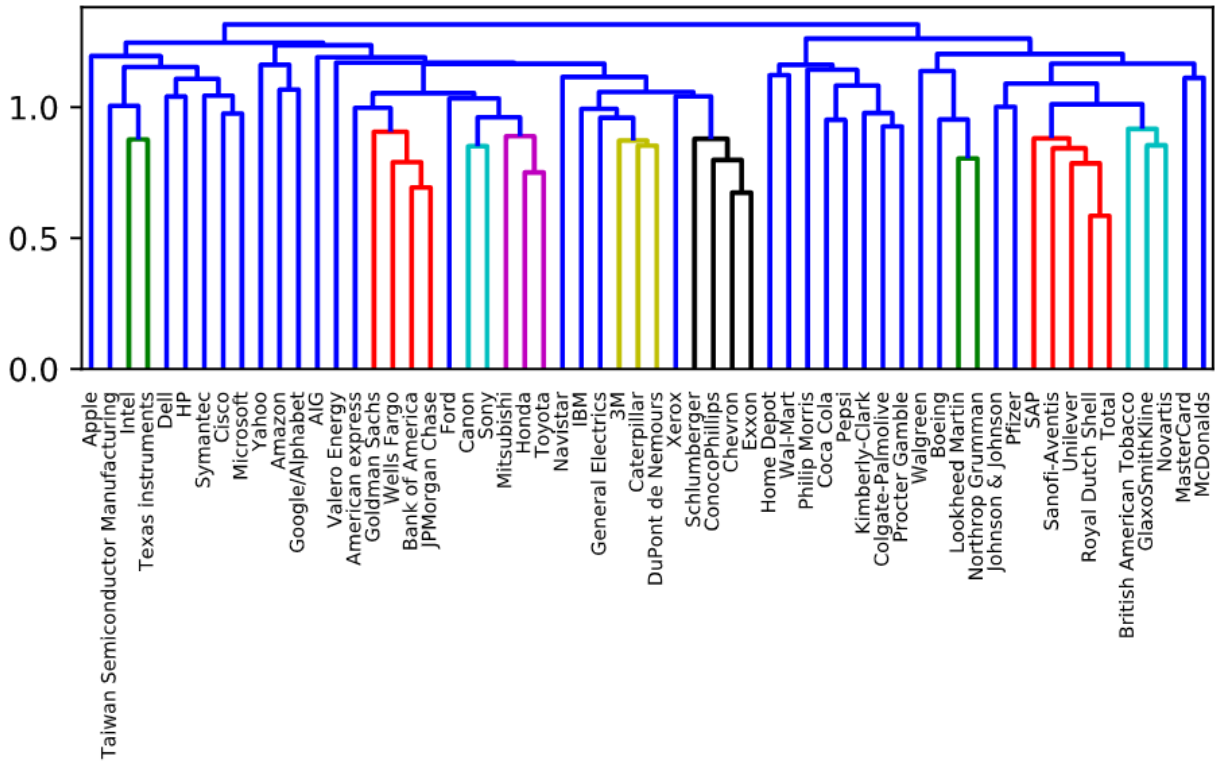
**a). Hierarchical Clustering of the grain data**

```
# Perform the necessary imports
from scipy.cluster.hierarchy import dendrogram, linkage
import matplotlib.pyplot as plt

# Calculate the linkage: mergings
mergings = linkage(samples, method='complete')

# Plot the dendrogram, using varieties as labels
dendrogram(mergings,
        labels=varieties,
        leaf_rotation=90,
        leaf_font_size=6,
)
plt.show()
```



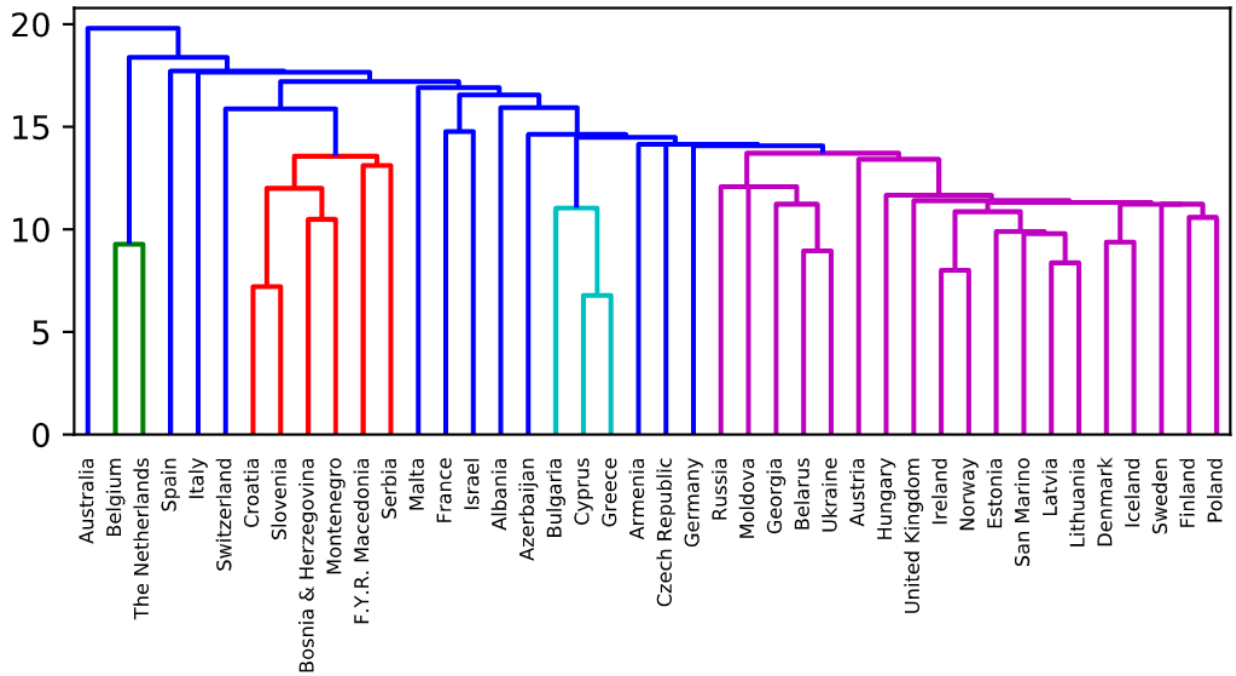
**b). Hierarchies of Stocks**

```
# Import normalize
from sklearn.preprocessing import normalize

# Normalize the movements: normalized_movements
normalized_movements = normalize(movements)

# Calculate the linkage: mergings
mergings = linkage(normalized_movements,'complete')

# Plot the dendrogram
dendrogram(mergings, labels=companies, leaf_rotation=90, leaf_font_size=6)
plt.show()
```



**c). <u>Different linkage, different hierarchical clustering!</u>**

```
# Perform the necessary imports
import matplotlib.pyplot as plt
from scipy.cluster.hierarchy import linkage, dendrogram

# Calculate the linkage: mergings
mergings = linkage(samples, method='single')

# Plot the dendrogram
dendrogram(mergings, labels=country_names, leaf_rotation=90, leaf_font_size=6)
plt.show()
```



**d). <u>Extracting the cluster labels</u>**

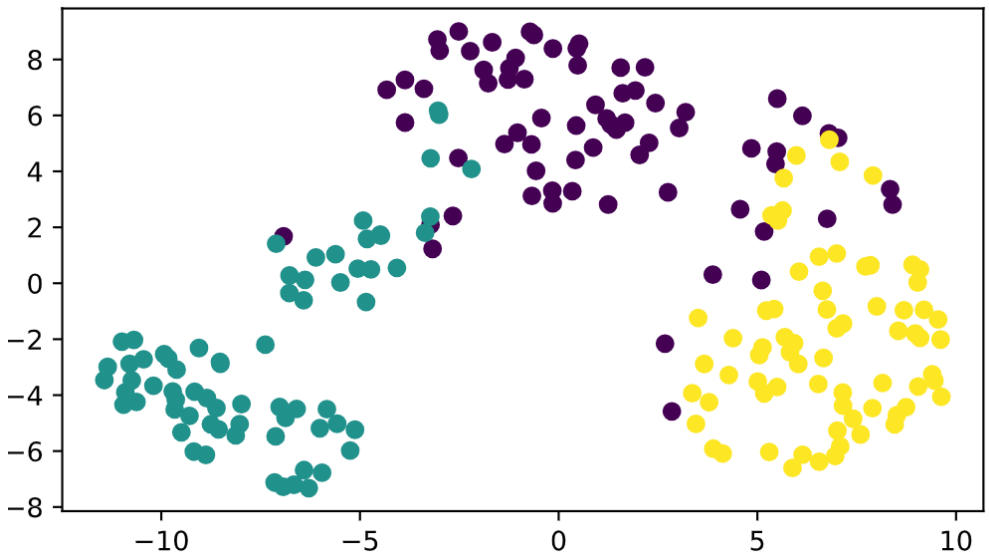
```
# Perform the necessary imports
import pandas as pd
from scipy.cluster.hierarchy import fcluster

# Use fcluster to extract labels: labels
labels = fcluster(mergings,6 , criterion='distance')

# Create a DataFrame with labels and varieties as columns: df
df = pd.DataFrame({'labels': labels, 'varieties': varieties})

# Create crosstab: ct
ct = pd.crosstab(df['labels'], df['varieties'])

# Display ct
print(ct)
```

<script.py> output:

| varieties | Canadian wheat | Kama wheat | Rosa wheat |
|---|---|---|---|
| labels | | | |
| 1 | 14 | 3 | 0 |
| 2 | 0 | 0 | 14 |
| 3 | 0 | 11 | 0 |

**e). t-SNE Visualization of grain dataset**

```
# Import TSNE
from sklearn.manifold import TSNE

# Create a TSNE instance: model
model = TSNE(learning_rate=200)

# Apply fit_transform to samples: tsne_features
tsne_features = model.fit_transform(samples)

# Select the 0th feature: xs
xs = tsne_features[:,0]

# Select the 1st feature: ys
ys = tsne_features[:,1]

# Scatter plot, coloring by variety_numbers
plt.scatter(xs, ys, c=variety_numbers)
plt.show()
```



**f). <u>A t-SNE map of the stock market</u>**

```
# Import TSNE
from sklearn.manifold import TSNE
# Create a TSNE instance: model
model = TSNE(learning_rate=50)
# Apply fit_transform to normalized_movements: tsne_features
tsne_features = model.fit_transform(normalized_movements)
# Select the 0th feature: xs
xs = tsne_features[:,0]

# Select the 1th feature: ys
ys = tsne_features[:,1]

# Scatter plot
plt.scatter(xs,ys,alpha=0.5)
# Annotate the points
for x, y, company in zip(xs, ys, companies):
    plt.annotate(company, (x, y), fontsize=5, alpha=0.75)
plt.show()
```